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ABSTRACT

In the current controversy over accountability in education, educators concerned with the affective aspects of education seem to be in danger of losing the battle of "behavioral objectives" on two fronts: (1) demonstrating that the affective behavior of the teacher does make a difference in educational outcomes, and (2) demonstrating how affective educational outcomes can be satisfactorily evaluated. The National Consortium for Humanizing Education addressed itself to the first of these questions; this document reports on three large N studies of teacher behavior. The first two studies indicate that in describing relationships with affective teacher behavior, it is necessary to move into polynomial models. The third study demonstrates that in predicting student outcomes, factors other than the linear term of the mean of the teacher's behavior add considerably to the predictive power of the model. Additionally, the fact that the teacher's stability of affective behavior is a significant predictor of student outcomes offers some implications which help explain why polynomial models of affective teacher behavior seemed to be more adequate than linear models. Extensive data graphs, tables, and charts are included. (Author/PC)

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POLYNOMIAL REPRESENTATION OF TEACHER BEHAVIOR

by

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In the current controversy over accountability in education, we educators concerned with the affective aspects of education seem to be in danger of losing the battle of "behavioral objectives" on two fronts: (1) demonstrating that the affective behavior of the teacher does make a difference in educational outcomes and (2) demonstrating how affective educational outcomes can be satisfactorily evaluated. The National Consortium for Humanizing Education addressed itself to the first of these questions and today I will report on three large N studies of teacher behavior.

The first two studies indicate that in describing relationships with affective teacher behavior, it is necessary to move into polynomial models. The third study demonstrates that in predicting student outcomes, other factors than the linear term of the mean of the teacher's behavior add considerably to the predictive power of the model. Additionally, the fact that the teacher's stability of affective behavior (her deviations around her own mean) is a significant predictor of student outcomes offers some implications to help explain why polynomial models of affective teacher behavior seem to be more adequate than linear models.

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STUDY NUMBER 1

SIXTH DEGREE ORTHOGONAL POLYNOMIAL MULTILINEAR REGRESSION ANALYSIS FOR TRENDS ACROSS TIME AMONG CLASSROOM FUNCTIONING VARIABLES

PURPOSE OF STUDY

This study posed two questions:

1. Will sixth degree orthogonal polynomial multilinear regression analysis yield significant non-linear trends across time among Classroom Functioning Variables (as measured by Flanders' Interaction Analysis Categories, Cognitive Functioning Categories, and Process Scales) for Control (No-Training Condition) groups and/or for Experimental (Training Condition) groups?

2. Are the trends for the Experimental groups different from those of the Control groups?

DESIGN

Sample

The sample for this study consisted of all Year 01 teachers who submitted 6 or more tapes, two of which were the September, 1971 and May, 1972 tapes. Total N for the study was 234. Table 29 displays the N by grade-level groups within treatment conditions.

Data Collection

Data for the study was the individual's score for each tape (month) on each of 10 Flanders' Interaction Analysis Categories, 10 Cognitive Functioning Categories, and 5 Process Scales. The data was collected by the regular procedures for assessment of tape data described in Part I.

ANALYSIS

The levels of the independent variable for this analysis were the nine months of the school year from September, 1971 to May, 1972 during which tapes were obtained from teachers

Table 29: Teacher Sample for Trend Analysis by Grade Level Groups Within Treatment Conditions

		Number of Teachers	
Grade Level Groups		Control	Experimental
1		9	11
2		12	10
3		11	10
4		11	10
5		11	12
6		10	11
7-9		11	26
10-12		29	40
Totals	1-6	64	64
	7-12	40	66
	1-12	104	130

at monthly intervals. The procedure used was a sixth-degree orthogonal polynomial multilinear regression analysis across time (months). Each regression coefficient was computed* independently of the others and each was tested for significance at the $p < .05$ level. If more than three coefficients were significant, they were eliminated on the basis of R^2 until only the three components achieving the highest R^2 remained. The resulting regression equation was used to generate the curve representing the trend of the behavior across time.

This procedure was repeated for each of the 25 study variables for each of the groups within each of the conditions. Since there were 10 groups (Grades 1, 2, 3, 4, 5, 6, all Elementary, grades 7-9, grades 10-12, All Secondary) for each of two conditions (Control and Experimental) for each of 25 variables, a total of 500 regressions were completed.

RESULTS

From Control Group Data

A question of some concern to the researchers was whether time of year might be a confounding factor for the study variables. Thus, the analyses of most interest in this study were those utilizing the data from the control groups. Table 30 displays the significant components of the polynomial expressions of the fitted curves for each analysis in which a significant trend was detected in the control data. Of the 250 analyses conducted with this data, 79 significant trends were detected. Twenty-four of these were in the 50 analyses with the data from School Level groups (All Elementary and All Secondary). When the teachers in the School Level groups were treated separately in grade level groups, the resulting 200 analyses yielded 55 significant trends with 41 occurring among the elementary grades and 14 occurring among the secondary groups.

Of the 79 significant trends, 70 were fitted with polynomial expressions which contained a linear term; 57 had a cubic component, and 32 had a quartic component. The majority of the curves had a decreasing function. (See further discussion below).

Three major forms of fitted curves occurred in this data. They are represented in Figure 4. The most commonly fitted curve was one with both linear and cubic terms. Thirty-nine curves were of this form but 14 of those had an added 5th

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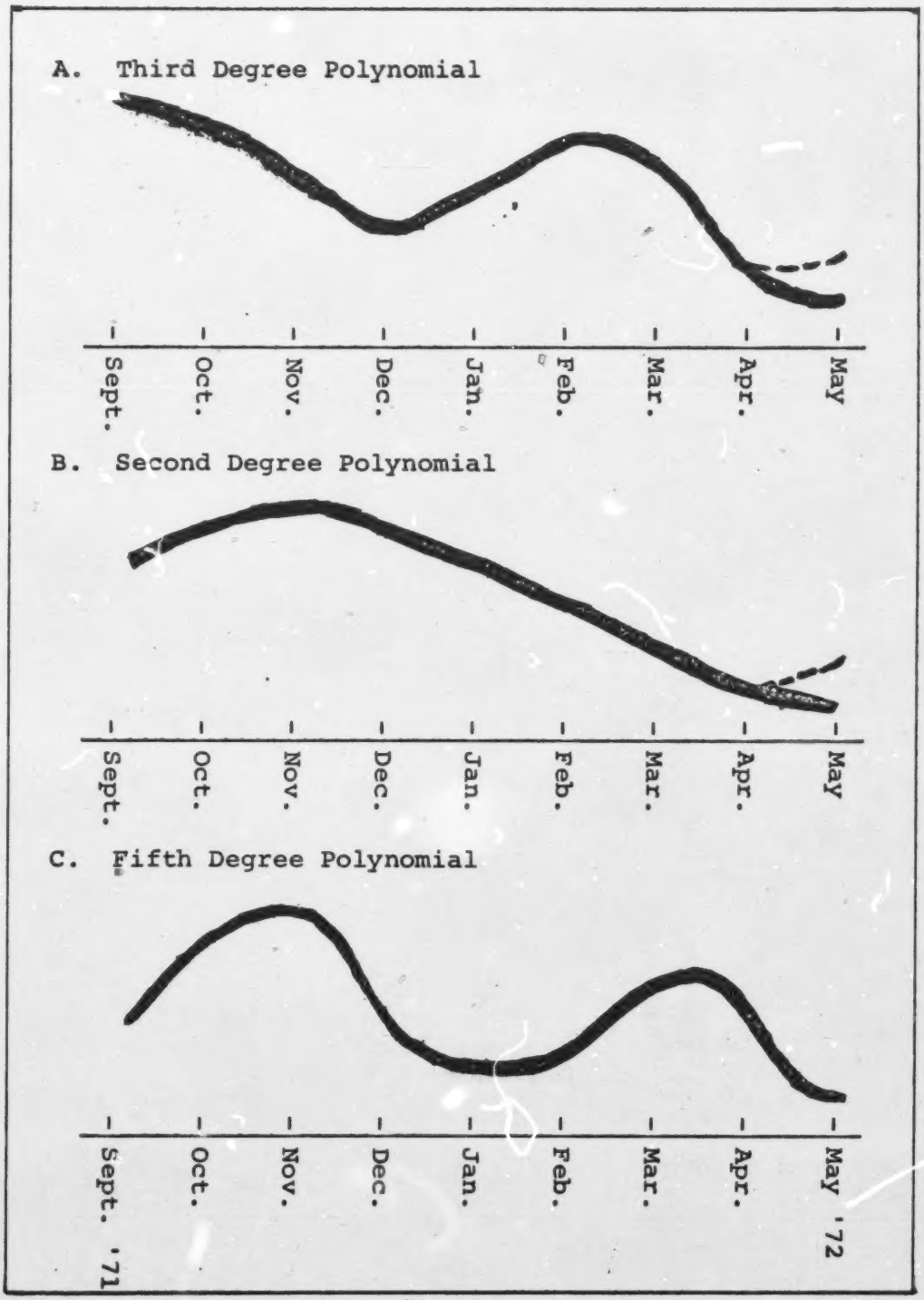
*Using procedures to compensate for unequal N of observations at time points.

Table 30: Significant Components of the Polynomial Expressions for Significant Trends Detected in Control Group Data

	By School Level		By Grade Level Groups							
	All Elem.	All Sec.	1	2	3	4	5	6	7-9	10-12
F-1	2,3,5	--	--	--	--	--	1,2,3	--	--	--
F-2	1,3,5	--	--	1,3,5	--	1,3	1,3,5	--	--	--
F-3	1,4,5	1,3	--	--	--	1,2,4	1,3,5	--	--	1,3
F-4	1,2,3	--	--	--	1,2	--	--	1,4	--	--
F-5	--	--	--	--	--	--	--	--	--	--
F-6	1,3,5	1,3,5	--	--	--	--	--	--	2,3,5*	--
F-7	--	--	--	--	--	--	--	--	--	--
F-8	1,3	--	1,3	--	--	--	--	--	--	--
F-9	--	--	1 *	--	--	--	--	--	--	--
F-10	1,3,5	--	--	--	--	--	--	--	--	1,3,5*
C-1	2,3,6	--	--	--	--	--	--	--	--	--
C-2	1,2,3	1,3	--	1,2,3	1,2	--	1,3	1,2,6	--	1,2,3
C-3	--	--	--	--	--	--	--	--	--	--
C-4	--	--	--	--	--	--	--	--	--	--
C-5	1,3	--	1,3	--	1,3,5	--	--	--	--	--
C-6	--	2,4,6 *	1,2	3	--	1,3 *	--	--	--	2,3,5*
C-7	--	--	--	--	1,3	--	--	--	--	--
C-8	--	--	--	--	--	--	--	--	--	--
C-9	--	--	1,3,5*	--	--	--	--	--	--	--
C-10	--	--	--	--	--	--	--	--	--	--
M	1,3	2,3	--	1,2	--	1,2	1,3,5	--	2,3,5	1,2
G	1,3	1,2,3	1,3	1,3	1,3,4	1,3	1,3,5	--	2,3,5	1,2
SP	1,3	1,2	--	--	1,2,3	1,2	1,3,4	--	1,2	1,2
R	1,3	1,3	1,2	--	1,3,5	1,2	1,3,4	1,2	1,2	1,3
SI	1,3	1,3	1,2	--	1,3,5	1,3	1,3	--	--	1,3

* = in same direction as the expected direction of treatment benefits for Experimental Groups.

Figure 4: General Forms of Commonly Occurring Significant Negative Trends in Control Group Data



degree component. (When compared with observed data, this quintic component usually occurred when there had been an April or May "recovery" from a decreasing function). Twenty-two trends were expressed with linear and quadratic components and 8 of these included a cubic term. (Again, this cubic term was associated with "recovery" from decreasing function in the observed data). The third repeated form was that of a fifth degree polynomial expression with the linear and quartic terms eliminated as insignificant. This form occurred five times and four of these were in the secondary grade-level groups (7-9 and 10-12).

From Experimental Group Data

Table 31 displays the significant polynomials of the fitted curves for each analysis in which a significant trend was detected in the data from Experimental groups. Of the 250 analyses conducted with this data, 97 significant trends were detected. Twenty-eight of these were in the 50 analyses with the data from School Level groups (All Elementary and All Secondary). When the teachers in the School Level groups were treated separately in grade level groups, the resulting 200 analyses yielded 69 significant trends with 38 occurring among the elementary grades and 31 occurring among the secondary groups.

Of the 97 significant trends, 46 were fitted with polynomial expressions which contained a linear term; 70 had a quadratic component, and 68 had a cubic component. About half of the curves had a decreasing function. (See further discussion below).

The forms of the fitted curves were not as consistent in the Experimental Data as in the Control data. However, of the 38 significant positive trends (in the direction* of anticipated treatment benefits) two general forms of fitted curves occurred commonly. They are represented in Figure 5. The arrows in the figure represent those points in time at which treatment (training of teachers) was applied. The most commonly fitted curve was one with both quadratic and cubic terms. Nineteen curves had this form, but 12 of those were cases in which the quadratic and cubic terms were components of a 5th or 6th degree expression. The second generally occurring form in this data was that of a 5th or 6th degree

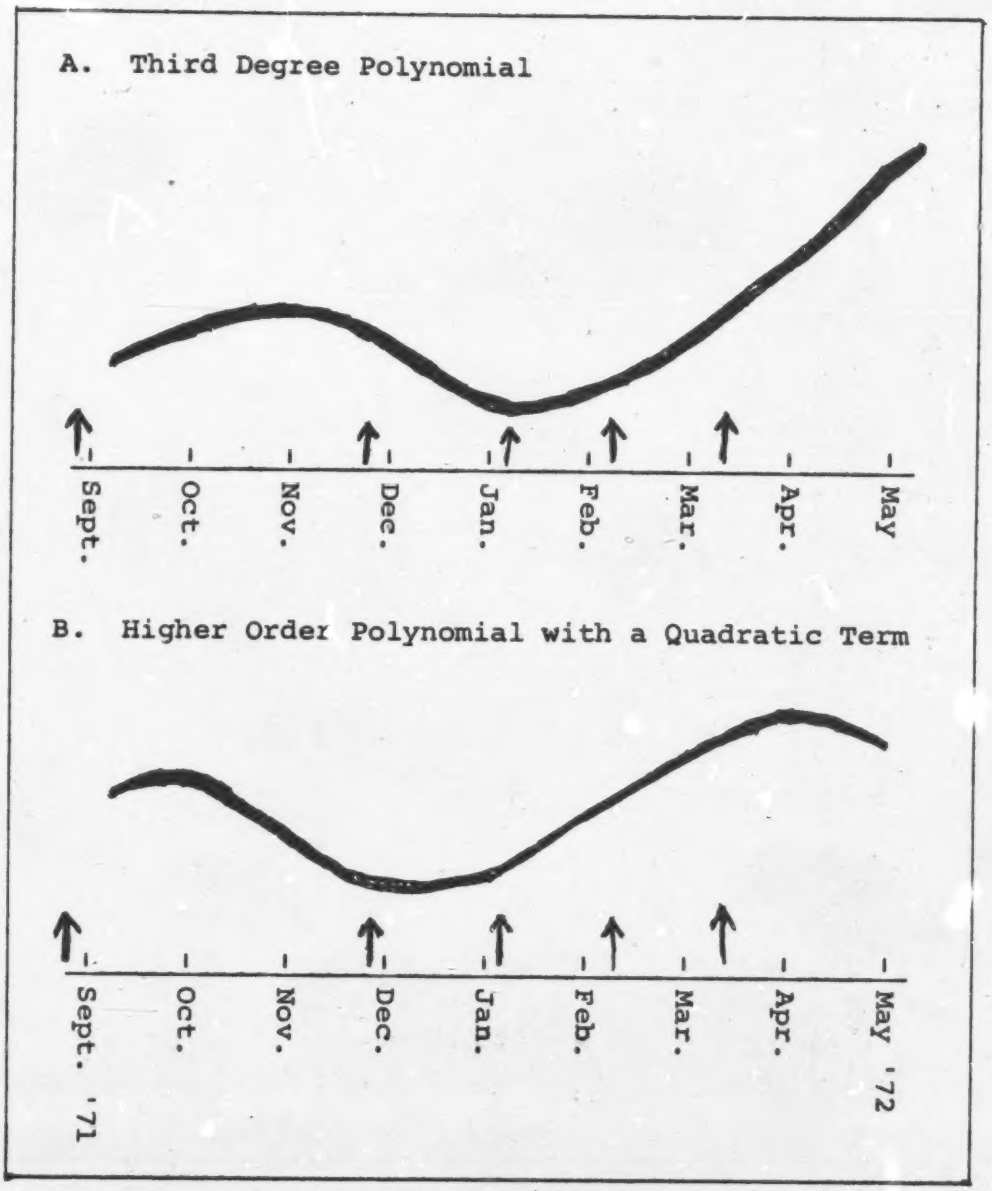
*Either an increasing or a decreasing function, depending upon whether high or low levels of the specific behavior were desired treatment benefits. Positive directions are indicated in Table 31 by a +.

Table 31: Significant Components of the Polynomial Expression for Significant Trends Detected in Experimental Group Data

	By School Level		By Grade Level Groups							
	All Elem.	All Sec.	1	2	3	4	5	6	7-9	10-12
F-1	--	--	--	--	--	--	--	--	1,2,3+	1,2,3
F-2	1,3,5+	1,2,3+	--	3,5,6+	2,3,5+	--	1,3,5+	2,3,6+	--	2,3,6+
F-3	--	1,2,3	--	--	2,5,6+	--	--	--	--	--
F-4	1,2,6	1,3,4	--	--	--	--	--	--	--	2,5
F-5	1,2,6	--	--	2,3,5+	--	--	--	--	2,3,4	--
F-6	--	3,4 +	3,4	1,2,3	1,3 +	1,2,3+	2,3,6	2,3,5	1,2,3+	1,2,3
F-7	--	--	--	--	--	--	--	1,2,3	3,4,5	--
F-8	2,3,5	--	1,3	3,5,6	--	--	1,2,6	--	2,3,4	--
F-9	--	--	--	--	--	--	--	--	--	3,5,6+
F-10	2,3,5	1,6	--	2,3,6+	--	--	--	1,2,3+	1,2,3	2,5,6+
C-1	1,2,6	--	1,3,5	2,3,5	1,2,3	--	--	--	2,3,4	--
C-2	1,3,6+	1,6	--	2,3,5	--	--	2,3,5+	--	--	2,3
C-3	--	--	--	--	--	--	--	--	--	--
C-4	--	1,5,6	--	--	--	--	--	--	1,2,3	2,3,5
C-5	2,3,6	--	1,2,3	3,5,6	--	--	--	--	2,3,4	--
C-6	--	--	--	--	--	--	--	--	--	--
C-7	--	1,2,3	--	--	1,2,3	2,3,4	--	--	--	1,2,4
C-8	--	--	--	--	--	--	--	--	--	2,3,5
C-9	--	--	--	--	--	--	--	--	1,2,3+	--
C-10	2,4,6	3,5,6	--	--	--	--	--	1,5,6+	1,2,3	2,5,6
M	1,2,3+	3,4	--	--	--	2,3,5+	--	1,2,4+	2,3,4	1,2,3
G	1,2,6+	3,4	--	--	2,3,5+	2,3,5+	--	1,4 +	2,3,4	2,4,5
SP	1,2,5+	4	2,3,5+	--	2,3,5+	--	--	1,4 +	2,3,4	1,2,4
R	1,2,5+	4	--	--	--	2,4,6+	--	--	2,3,4	3,5,6
SI	1,2,5+	4	--	1,2,5+	1,2,3+	--	--	--	3,4,5	--

+ = in expected direction of treatment benefit

Figure 5: Two General Forms of Commonly Occurring Significant Positive Trends in Experimental Group Data With Applications of Treatment Indicated



polynomial expression which included a significant quadratic component as one of three terms. This form occurred 8 times.

From Comparison of Control versus Experimental Trends

The trends for each dependent variable were compared for each of the grade-level groups. Of the 400 trend analyses carried out with data from grade-level groups, the regression was significant in 124 cases. These cases were so distributed that at least one regression of the pair was significant in 102 of a possible 200 paired comparisons (the comparison of the trend of a behavior variable in grade-level matched experimental vs. control groups).

Table 32 displays the results of the comparison. The symbols used are defined in the table; but, to summarize, the "+" and "-" symbols denote the direction of the behavior trends while the letters and numbers indicate significance. Specifically, a "+" denotes a favorable comparison; i.e., one in which it can be considered that the Experimental group has moved in the expected direction of treatment benefit as indicated by (1) a significant positive trend of the experimental group paired with either a significant control group trend in the opposite direction or with a non-significant control group in the same or opposite direction or (2) a non-significant positive trend of the experimental group paired with a significant control group trend in the opposite direction.

Similarly, a "-" denotes an unfavorable movement of the Experimental group away from the expected direction of treatment benefit as indicated by (1) a significant negative trend of the experimental group paired with either a significant control group trend in the positive direction or with a non-significant control group trend in the same or opposite directions or (2) a non-significant negative trend of the experimental group paired with a significant control group trend in a positive direction.

The letters "ND" indicate that both trends were in the same direction. A "+X" or "-X" standing alone or with the letters "ND" indicates that only the experimental trend was significant. The letter "C" immediately following the directional symbol ("+" or "-") indicates that only the control trend was significant while the number "2" following the directional symbol indicates that both the control and the experimental trends were significant.

The incidence of favorable and unfavorable comparisons are summed by grade-level groups in Table 33. Elementary Teachers have more favorable than unfavorable comparisons (44 to 23) while the Secondary teachers have more unfavorable ones.

Table 32: Summary of 6-Degree Polynomial Multilinear Regression Analysis Across Time -- Direction & Treatment Assignment of Significant Behavior Trends for 200 Paired Analyses of Experimental & Control Grade-Level Groups

Variables	Elementary Schools by Grade						Secondary by Grade	
	1	2	3	4	5	6	7-2	10-12
F-1	--	--	--	--	+C	--	+X	-XND
F-2	--	+2	+X	+C	+2	+X	--	+X
F-3	--	--	+X	+C	+C	--	--	+C
F-4	--	--	+C	--	--	-2ND	--	-XND
F-5	--	+X	--	--	--	--	-XND	--
F-6	-XND	-XND	-XND	+XND	-XND	-XND	+2ND	-XND
F-7	--	--	--	--	--	-XND	-XND	--
F-8	-2ND	-XND	--	--	-XND	--	-XND	--
F-9	-C	--	--	--	--	--	-XND	+X
F-10	--	+X	--	--	--	+XND	-XND	+2ND
C-1	-XND	-XND	-XND	--	--	--	-XND	--
C-2	--	-2ND	+C	--	+2	-CND	--	-2ND
C-3	--	--	--	--	--	--	--	--
C-4	--	--	--	--	--	--	-XND	-XND
C-5	-2ND	-XND	-CND	--	--	--	-XND	--
C-6	+CND	+C	--	+CND	--	--	--	-C
C-7	--	--	-XND	-XND	--	--	--	-XND
C-8	--	--	--	--	--	--	--	-XND
C-9	+CND	--	--	+X	--	--	+X	--
C-10	--	--	--	--	--	+XND	+XND	+XND
M	--	+C	--	+2	+C	+X	-2ND	-2ND
G	+C	+C	+2	+2	+C	+X	-2ND	-2ND
SP	+XND	--	+2	+C	--	+X	-2ND	-2ND
R	+C	--	+C	+2	+C	+C	-2ND	-2ND
SI	+C	+X	+2	+C	+C	--	-XND	+C

Symbols Used

When only Experimental Trend is Significant:

+X Experimental trend toward, and control away from, expected direction.
-X Experimental trend away from, and control toward, expected direction.
+XND No Difference -- both trends away from desired direction: control non-sig.
-XND No Difference -- both trends away from desired direction: control non-sig.

When both Experimental and Control Trends are Significant:

+2 Experimental trend toward and control away from expected direction.
-2 Experimental trend away from and control toward expected direction.
+2ND No Difference -- both trends significant in expected direction.
-2ND No Difference -- both trends significant away from expected direction.

When only Control Trend is Significant:

+C Experimental non-sig. trend is desired direction with control away from it.
-C Experimental non-sig. trend away from desired direction with control toward expected direction.
+CND No Difference -- both trends in expected direction; experimental non-sig.
-CND No Difference -- both trends away from expected direction; experimental non-sig.

-- Neither group significant

Table 33: Summary of Favorable Versus Unfavorable Comparisons of Experimental Group Trends with Control Group Trends

	Grade-Level Groups	No. Favorable* Comparisons	No. Unfavorable Comparisons
Elementary	1	6	5
	2	7	5
	3	8	5
	4	10	2
	5	8	2
	6	7	4
Secondary	7-9	4	13
	10-12	6	11
Totals	Elementary	46	23
	Secondary	10	24
	All	56	47

*Favorable comparison: one in which it can be considered that the Experimental group has moved in the expected direction of treatment benefit.

Closer examination of Table 32 indicates that the Elementary school teachers generally have favorable comparisons on the Interpersonal Process (M, G, SP, R, SI) and Indirect Behavior (F-1, F-2, F-3, F-4) variables. The picture for the Secondary Schools is not as favorable as that of the Elementary Schools but the Senior High School (grades 10-12) does better than the Junior High (grades 7-9).

Although the data exhibits negative movement for the experimental groups, these are usually accompanied by negative movement of the matching control group as well. There is no case in which the experimental group had a significant negative direction accompanied by a significant positive direction for the control group. There are two cases (indicated by "C" in Table 32) in which the experimental group had a non-significant negative movement paired with a significant positive movement of the control group.

DISCUSSION

The "-XND", "-2ND", "+C", and "-CND" symbols registered in Table 32 are reflective of a general tendency which was found in the data. This tendency was most marked in the significant trends for the control group data. (See Table 30).

That is, in general[21], the behavior trend for the control group was a movement across the year from September to May towards increased amounts of direct teacher behavior (F-5, F-6, F-7, C-1), increased amounts of Silence and Chaos (F-10, C-10), lower levels of student participation (F-8, F-9, C-5, C-6, C-7, and C-8), and less facilitative levels of interpersonal processes. This was not strictly a linear trend and, of course, it varied considerably among grade-levels and variables but, in general, it showed a decreasing function from September through December or January, a partial recovery in January or February, and a second downward trend through May. For some variables there was a second slight recovery in May, ending the downward trend with April. (See A and B of Figure 4).

Thus, for the experimental group to show positive movement, they had to over-come this general downward trend before positive movement could be evidenced. The symbol "+C" in Table 32 indicates cases in which a significant negative trend in the control group is paired with a non-significant positive trend

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[21]Exceptions are indicated by * in Table 30.

of the experimental group. These cases are interpreted as being instances in which the experimental group succeeded in breaking up the negative trend but not in making significant positive movement. The symbols "-ND", "-2", "-2ND" in Table 32 indicates those cases in which the experimental group reflected the general negative tendency of the data.

The general trend across time for the experimental groups was not as consistent as for the control groups, which also substantiates the concept of the experimental treatment benefits being in a direction opposed to the direction of the normal processes evidenced across the school year. Of the 97 significant trends detected in the experimental data, 38 were in the direction of expected treatment benefits. For the control groups, only 7 of the 79 significant trends were in this direction.

While examining the behavior trends across time, anecdotal evidence was discovered indicating that the measures selected for the study do reflect classroom processes accurately. This was found in the data taken in the week immediately following two racial incidents (a rape and a stabbing) in one of the secondary schools. The data for that time period (Feb., 1972) supplied by the faculty of the school which was involved in the racial incidents exhibited a severe depression in the variables most directly related to facilitative interpersonal processes. Thus, the data for that month for that school showed (1) marked decreases (from the levels attained in both the month preceding and the month following) in amount of praise given, questions asked by pupils, and student ideas accepted, and (2) a sharp increase in criticism and justification of authority and the amount of silence or confusion in the classroom. Decreases were also registered in the levels of the teacher's Meaning, Genuineness, Respect for Students, Success Promotion, and in the degree of Student Involvement in classroom processes.

SUMMARY

In conclusion, the findings from this study were:

1. The data supplied anecdotal validation that the measures selected for the project do reflect classroom process accurately.

2. Significant trends across time were found in the Control group data.

3. These trends were consistent with the interpretation that there is a deterioration across the year from September till May in the levels of facilitative conditions offered students.

4. Significant trends across time were detected in the Experimental Group data.

5. These trends were not as consistent as the trends from the Control data but were compatible with the interpretation that the benefits of the treatment applied (training of teachers) were in directions opposed to the direction of the normal processes evidenced across the school year.

6. Of the 97 significant trends in the Experimental data, 38 were in the direction of expected treatment benefits.

The first implication of this study for the applied research studies was that time of year was a confounding factor for the study variables and must be taken into consideration in the interpretation of research results. Secondly, a comparison of (1) the variables in which positive movement was evidenced and (2) the content of the training sessions for the year indicates a correspondence between the skills in which instruction was explicit and the variables in which movement was exhibited. This comparison led to the hypothesis that for the attainment of desired treatment benefits in additional variables, specific skills development training programs for those behaviors should be applied. To test this hypothesis, the training modules for the second year would have to undergo revision.

STUDY NUMBER 2

RESPONSE SURFACE ANALYSIS*

PURPOSE OF STUDY

This study posed four questions:

1. Can replicable, predictable, and significant relationships be detected among Classroom Functioning Variables as measured by Flanders' Interaction Analysis categories, Cognitive Functioning Categories, and Process Scales?

2. Will these relationships be different at the elementary and secondary levels?

3. Can specific recurring predictors be identified for each of the Classroom Functioning Variables?

4. Can response surfaces generated from the regression equations resulting from backward elimination multilinear regression analysis provide information that will be useful in guiding the design of training programs?

DESIGN

Sample

The sample for this study was all Year 01, Year 02, and Year 03 teachers who submitted 5 or more tapes during the year. Table 38 presents the data base for the study.

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*This study is only summarized here as it was presented in detail in F. N. Roebuck and D. N. Aspy, Response Surface Analysis: Interim Report No. 3. Monroe, LA: National Consortium for Humanizing Education, Northeast Louisiana University (National Institute of Mental Health Research Grant No. 5 P0 1 MH 19871), 1974. Separate presentation of this study was necessary because it involved 86 pages of illustrations of response surfaces generated from the analyses.

Table 38: Data Base for Response Surface Analysis

	Elementary			Secondary		
	Yr. 01	Yr. 02	Yr. 03	Yr. 01	Yr. 02	Yr. 03
No. of Teachers	162	132	55	98	60	44
No. of Hours of Instruction Coded	1,194	974	322	607	376	225

Data Collection

Study variables were the individual's scores on 10 Flanders' Interaction Analysis Categories, 10 Cognitive Functioning Categories, and 5 Process Scales. The data was collected through the normal procedures for assessment of tape data described in Part I.

ANALYSIS

Response Surface Analysis was carried out for each of the 25 study variables. The procedure used was to designate each of the study variables in turn as the dependent variable with the remaining 24 variables being considered as independent. The computer was then loaded with the linear, quadratic, and cross-product values of the independent variables and backward elimination multilinear regression analysis was carried out. The procedure was continued until only two variables were left in the model. The resulting regression equation was used to generate points with which to plot the response surface. The regression equation with 3 variables was also identified and a 3-variable response surface was generated for each study variable.

The analysis for each study variable was carried out separately for elementary (grade 1-6) and secondary (grade 7-12) teachers as it was anticipated that the relationships would be different at the two levels. Since there were three samples (Year 01, Year 02, and Year 03) at each level which were analyzed separately, a total of 150 analyses were conducted. Each analysis yielded two response surfaces -- a 2-variable surface and a 3-variable surface--for a total of 300 surfaces which were constructed.

RESULTS

From Regression Analysis

A majority of the regressions were significant at $p < .001$; however, they ranged as high as $p < .75$. Acceptable levels of significance were $p < .05$. Only 19 of the 150 regressions failed to achieve this level of significance. Variable F-7 at the Secondary Level was the only variable which was consistently insignificant; it failed to reach the .05 level in all three samples.

Achieved R^2 for the three-variable equations ranged from .01 to .99. Some variables were predictable at approximately the same levels of R^2 from sample to sample (within a school

level) while other variables showed wide differences in achieved R^2 among samples. A methodical comparison of the R^2's provided an estimate of the stability of predictability of the study variables from sample to sample. Table 39 summarizes the results of this comparison.

Some study variables consistently predicted the same dependent variables from sample to sample within a school level. These predictors were designated "Recurring Variables." Table 40 presents the Recurring Variables for each dependent variable at each school level.

It is obvious from scanning Table 40 that some variables featured more frequently as predictors of the other study variables. The relative frequency of each of the study variables as a predictor is summarized in Table 41.

From Construction of Response Surfaces

The 300 response surfaces generated from the 150 2-variable and the 150 3-variable regression equations derived from the three samples at each of two school levels were examined for information as to the dynamic relationships among the variables. Each surface presented its own exhibit of the dynamics of the inter-relationships of the study variables; however, two general observations could be made of the surfaces as a set.

First, many of the variables were related to the dependent variable in a curvilinear rather than a linear fashion. All but 11 of the 150 2-variable regression equations contained at least one quadratic or cross-product term, while 146 of the 3-variable equations contained such a term.

Second, the surfaces emphasized the dynamic quality of the inter-relationships of the predictor variables. In several cases, the directionality of the relation between the dependent variable and a predictor variable was completely reversed as the value of a second predictor variable changed.

DISCUSSION

One of the major reasons for conducting this extensive examination of the relationships between Classroom Functioning variables was the need of the researchers to be able to specify the expected direction of treatment benefit for each of the 25 study variables. The National Consortium for Humanizing Education had hypothesized that a humane classroom was characterized by four types of behavior:

Table 39: Stability of Predictability of Study Variables from Sample to Sample within School Levels

			Elementary Level	Secondary Level
Stable	With Consistently +Ample R^2		F-5 C-2 C-4 C-7 C-10 M G SP R SI	F-5 F-10 C-2 C-10 M R SI
Stable	With Consistently Low R^2		F-2	F-7* F-8*
Not Characterized as to Stability		Ample R^2	F-4 F-10	F-3 C-4 C-5* C-9* SP
Not Characterized as to Stability		Low R^2	F-6 F-8* F-9 C-1*	F-6* F-9 C-8*
Unstable	With Inconsistently Ample R^2		C-9	F-4 C-7 G
Unstable	With Inconsistently Low R^2		F-1* F-3* F-7 C-3* C-5* C-6 C-8*	F-1* F-2* C-1* C-3* C-6

*Indicates that at least one of the 3 regressions within the school level for the variable did not reach $p < .05$.

+Ample R^2 was defined as $R^2 > .35$ in at least two of the three samples.

Table 40: Recurring* Predictive Variables

Dependent Variable	Elementary Teachers: Variables Recurring as Predictive of Dependent Variable in Equations for 2 Samples	Elementary Teachers: Variables Recurring as Predictive of Dependent Variable in Equations for 3 Samples	Secondary Teachers: Variables Recurring as Predictive of Dependent Variable in Equations for 2 Samples	Secondary Teachers: Variables Recurring as Predictive of Dependent Variable in Equations for 3 Samples
F-1	M, C-7	F-9	M, SI	C-7
F-2	SI	C-2, M	C-7, C-5	SI
F-3		C-7, SI	C-4, SI	C-2
F-4	R, C-5, C-7	C-6	SP, R, C-7	C-5
F-5	R, C-3	C-5	C-5, R	M
F-6	M, C-1, C-2, SI		SI	F-10, C-1
F-7		C-1, M, C-2		C-1, M
F-8	C-2	F-7, R	R, C-2	F-2
F-9	C-2	M	C-2, SP, F-2, F-1	
F-10	SI, C-2	C-1	C-2, SI	C-1
C-1	M, R, C-6	C-8	C-6	R, M
C-2	M	F-4, C-7		F-4, R, C-7
C-3	F-2	F-5, C-8	F-5, C-8	G
C-4		C-7, F-4, M	F-3, F-4, M	C-7
C-5	F-4, F-7	R	R, F-4	F-7
C-6	F-4, F-8, SI		F-3, SI, F-8	
C-7	F-8, SP	C-4		C-4, F-1
C-8	M, SI, C-3, C-4		C-3, M, F-1, SI	
C-9	F-1	F-7, M	F-3, F-7, C-7	M
C-10	C-4, F-5	SI	F-6	F-5, SI
M		R, F-2	C-1, C-7	R
G	F-7, M	F-2	F-7, F-2, M	C-1
SP	F-2, C-4, M, C-1		M, C-1, F-2	
R	C-7, F-3	G	F-1, C-7	G
SI	F-1, C-7	G		G, C-7

*Recurring from sample to sample as predictor for same dependent variable.

Table 41: Summary of Predictive Appearances of Recurring Variables

	Predictive Variables	No. of Appearances		
		Total	Elementary Data	Secondary Data
M:	Meaning	53	29	24
C-7:	Student Thinks	39	17	22
SI:	Student Involvement	34	16	18
R:	Respect	32	15	17
C-1:	Teacher Recalls Facts	25	10	15
C-2:	Teacher Asks for Facts	23	14	9
F-2:	Teacher Praises	19	10	9
F-4:	Teacher Asks Questions	17	10	7
F-7:	Teacher Criticizes	17	10	7
G:	Genuineness	15	6	9
C-4:	Teacher Asks for Thinking	14	9	5
F-1:	Teacher Accepts Feelings	13	4	9
C-5:	Student Recalls Facts	12	5	7
F-5:	Teacher Lectures	10	5	5
F-3:	Teacher Accepts Ideas	8	2	6
C-8:	Student Asks for Thinking	8	6	2
C-3:	Teacher Thinks	7	5	2
C-6:	Student Asks for Facts	7	5	2
F-8:	Student Responds	6	4	2
SP:	Success Promotion	6	2	4
F-9:	Student Initiates	3	3	*
F-10:	Silence or Confusion	3	*	3
F-6:	Teacher Gives Directions	2	*	2
C-9:	Non-Cognitive Behavior	*	*	*
C-10:	Silence and Confusion	*	*	*

*Variable occurred only at random in this data; i.e., it did not recur from sample to sample within a level as predictor for the same dependent variable.

1. Frequent acceptance of student feelings,

2. High amounts of student participation,

3. High levels of student thinking beyond the use of facts, and

4. High degrees of student involvement.

From this hypothesis, the expected direction of treatment benefits was self-evident for variables F-1, F-8, F-9, C-7, and the Process Scales. And from the implications of directionality of these variables, expected direction could be derived for variables F-2, F-3, F-4, C-2, and C-4. However, the implications for F-5, F-6, F-10, C-1, C-3, C-5, C-6, C-9 and C-10 were not so clear. By examining the response surfaces generated in this study, it was possible to specify the expected direction of treatment benefit for all variables.

Examination of the individual response surfaces also provided guidance for focusing training to change specific aspects of teacher or student behavior. For example, examination of the response surfaces for F-9 (Figures 6 & 7) suggested that in order to increase the amount of Student Initiation at the elementary school level, training should focus on helping the teacher to understand the meaning-to-the-student of his classroom experiences and to communicate acceptance of the student's feelings. At the high school level, training to increase Student Initiation should focus on helping the teacher (1) to raise his levels of skill in promoting the student's achievement of individual goals and (2) reduce the amount of time he spends asking students to recall facts. (See Figures 6 and 7).

SUMMARY

In conclusion, the findings from this study are:

1. Replicable, predictable, and significant relationships were detected among variables of teacher and student classroom functioning.

2. These relationships were different at the secondary and elementary school levels.

3. Specific recurring predictors for each of the study variables were identified.

4. Some of the classroom functioning variables co-varied significantly and frequently with a large number of the other study variables, and these

predictors were few enough in number to suggest that efficient programs for changing overall classroom functioning could be developed by focusing training efforts on these few highly predictive variables.

5. The individual response surfaces generated for each study variable provide specific suggestions for focusing training efforts aimed at changing selected aspects of teacher or student behavior.

6. Two of the 4 most frequently recurring predictors (and 3 of the top 10) were variables which had been postulated by Rogers as being positively related to effective learning environments.

7. Most of the frequently recurring predictors were related to the kinds of behavior classified by Flanders' as "Indirect."

8. The kinds of behavior hypothesized by the National Consortium for Humanizing Education as characterizing a humane classroom were also the kinds of behavior which were frequently recurring predictors of the other study variables.

9. The curvilinear relationships detected were strong enough and constant enough to suggest that educational researchers need to emphasize the building and testing of at least quadratic models.

The most important implication of this study for the NCHE applied studies was the specification of the expected direction of treatment benefits for each of the 25 classroom functioning variables. However, the other findings from this study have important implications for applied research in education in general. Also, the methodology (Response Surface Analysis) seems a promising one for researchers in education and other social sciences.

Figure 6: Response Surface for
F-9: STUDENT INITIATES at the Elementary School Level

$F\text{-}9 = 6.59066 - 47.9076F1F1 + 15.013F1M$

$R^2 = 0.172$ $s_E = 5.945$ $\underline{F} = 16.559$

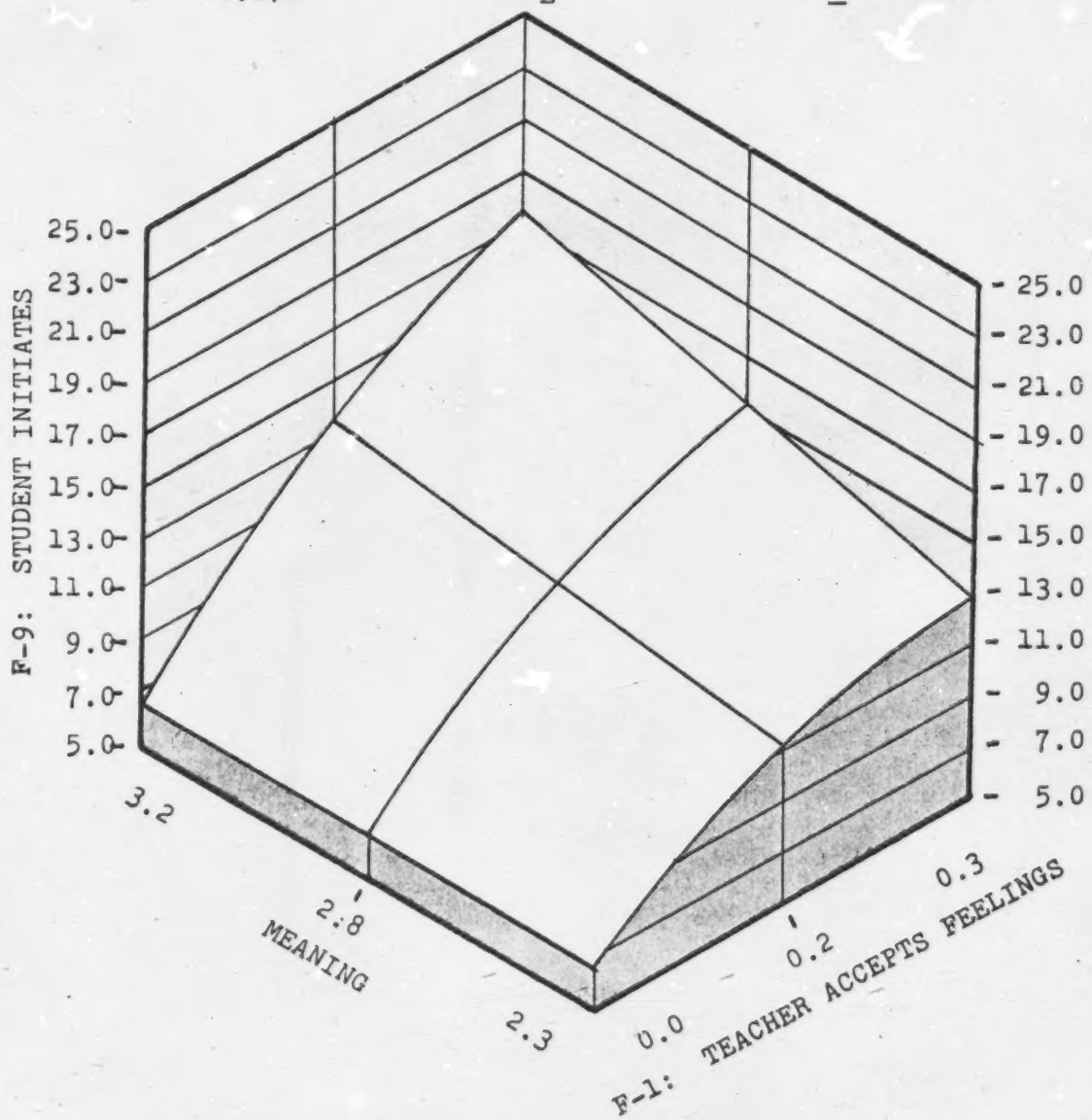
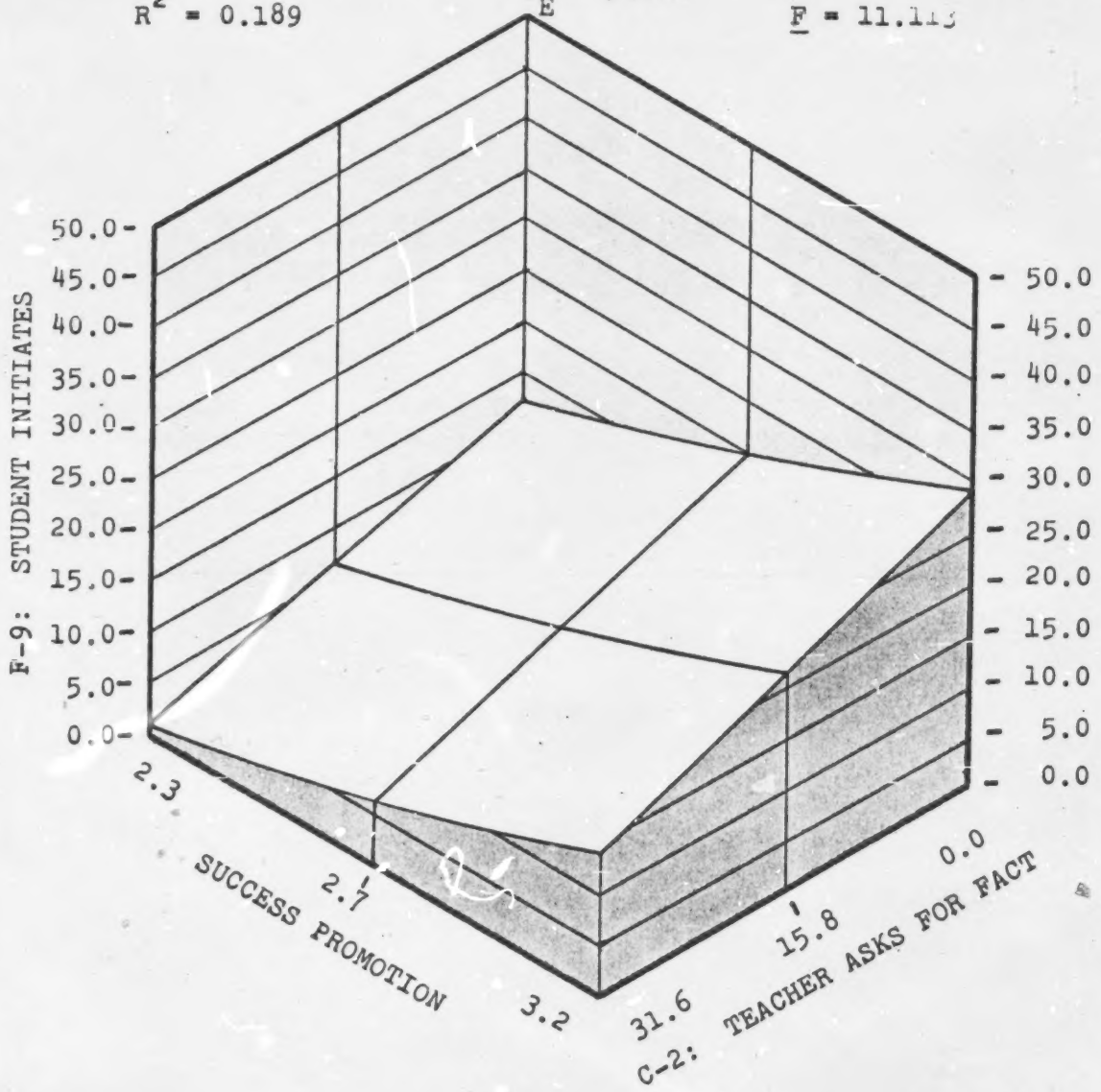


Figure 7: Response Surface for
F-9: STUDENT INITIATES at the Secondary School Level

F-9 = - 5.07259 - 0.153C2SP + 0.334SPSP

R^2 = 0.189 s_E = 9.408 $\underline{F}$ = 11.1[illegible]



STUDY NUMBER 3

THE CLASSROOM FUNCTIONING VARIABLES AS PREDICTORS OF CHANGE ON STUDENT OUTCOME MEASURES OF ABSENTEEISM, SELF-CONCEPT, AND ACHIEVEMENT

PURPOSE OF THE STUDY

This study posed two questions:

1. When Student Outcome Measures of change have been adjusted for pre-test standing, will multi-linear regression analysis detect significant relationships between the adjusted change measures and the Classroom Functioning variables?

2. Which Classroom Functioning variables are the better predictors of the adjusted change measures?

DESIGN

Sample

The Teacher sample for this study included all Year 01 experimental and control classroom teachers who submitted four or more tapes during the year. "Special teachers" (art, music, speech therapy, etc.) were not included and the study was restricted to Math and English Teachers at the Secondary level. The student sample was formed of all students who (1) had been taught by "included" teachers and (2) had taken pre- and post-tests of student outcome measures. Table 56 displays student and teacher N by grade level.

Data Collection

Data for the independent variables in the study were the individual's scores on all submitted audio tape recordings of classroom instruction on each of the 10 Flanders' Interaction Analysis Categories, 10 Cognitive Functioning Categories, and 5 Process Scales. The data was collected by the regular procedures for assessment of Tape data described in Part I.

The dependent variables were pre-and post-test measures on Metropolitan Achievement Tests (for students in grades 1-6),

Table 56: Distribution of Sample for Study 14 by Grade Level

Grade Levels		Teacher N	Student N
1		20	442
2		22	488
3		21	451
4		21	492
5		23	532
6		15	485
7-12	Math	16	1,365*
	Engligh	18	2,113
Total		156	5,003

*These students contained within English N.

California Achievement Tests (for students in grades 7-12), How I See Myself Tests (students in grades 3-12), and total days absent for the year (for all students). The pre-tests were administered in November, 1971 and the post-tests in April, 1972 by the students' regular classroom teachers and scored by the test publishers.

ANALYSIS

Sixty-four multi-linear regression analyses were carried out. The dependent variables were adjusted change* scores on student tests. Table 59 lists the dependent variables. Separate analyses were carried out for grade levels, 1, 2, 3, 4, 5, 6, and 7-12. Grades 7-12 were run as one level because of organizational factors of the schools; i.e., all students changed classes thus limiting the number of teachers in a particular subject matter to two or three per grade.

Independent variables were means and standard deviations of measures of selected Classroom Functioning Variables. The teacher's Grand Mean** for the year was used as a measure of average level of functioning. The standard deviation of the teacher's scores around his own mean was used as an estimate of stability of functioning. In all there were 28 Independent Variables, as follows:

X and $\hat{0}$ of F-1:	Accepts Student Feelings
X and $\hat{0}$ of F-2:	Use of Praise and Encouragement
X and $\hat{0}$ of F-3:	Accepts Student Ideas
X and F-6	Give Directions or Commands
X and $\hat{0}$ of F-7:	Use of Criticism and Justification of Authority
X of F-9:	Student Initiated Response
X of C-1:	Teacher Recalls Facts

---

*Adjusted change was post-test minus pre-test to yield raw change which was then adjusted for pre-test standing. This was done for all variables except (1) first grade tests where absolute post-test scores were used as no pre-test data was available and (2) absence where total days absent was the dependent variable.

**Grand Mean = average over all tapes submitted.

$\bar{X}$ Of C-2:	Teacher Asks for Facts
$\bar{X}$ and $\hat{\sigma}$ of C-3:	Teacher Thinks
$\bar{X}$ and $\hat{\sigma}$ of C-4:	Teacher Asks for Thinking
$\bar{X}$ of C-5:	Student Recalls Facts
$\bar{X}$ Of C-6:	Student Asks for Facts
$\bar{X}$ of C-7:	Student Thinks
$\bar{X}$ of C-8:	Student Asks for Thinking
$\bar{X}$ and $\hat{\sigma}$ of M:	Teacher's Understanding of Meaning to Student of Classroom Experiences
$\bar{X}$ and $\hat{\sigma}$ of G:	Teacher's Genuineness in Person-to-Person Interactions
$\bar{X}$ of SP:	Teacher's Promotion of Success of Student's Goals
$\bar{X}$ of R:	Teacher's Respect for Students
$\bar{X}$ and $\hat{\sigma}$ of SI:	Student's Involvement in Learning Activities

In carrying out the regressions, the measures of each teacher's functioning were regressed against the Mean Change on the dependent variable for the students taught by that teacher. Therefore, degrees of freedom for each analysis were based on N of classrooms (teachers) rather than N of students. Since the N of classrooms was in all cases smaller than the number of independent variables to be considered, the computer was programmed to halt computation when the degrees of freedom for regression were equal to residual degrees of freedom minus one.

RESULTS

Prediction of Change

The R-squares displayed in Table 57 represent the amount of remaining variance predicted by Classroom Functioning variables after the variance due to Pre-test Standing had been removed. In other words, once you have accounted for change related to where the student was on entering, then these R-squares tell you how good teacher behavior was as a predictor of change. All regressions for which R-square is reported were significant at $p < .05$.

Table 57: Results of Multilinear Regression Analysis: Variation (R^2) in Adjusted* Mean Gain Predicted by Teacher Behavior Factors

	Dependent Variables	Grade Levels 1	2	3	4	5	6	7-12
Self-Concept Factors	Teacher School Acceptance	X	X	.41**	.23	.53	.61	.73
	Physical Appearance	X	X	.78	NS	.64	.45	.82
	Interpersonal Adequacy	X	X	.81	NS	.85	.48	.86
	Autonomy	X	X	.63	.19	.75	.45	.88
	Academic Adequacy	X	X	.29	.14	.73	.69	.84
	Total Days Absence	.71	.84	NS	.14	.42	.38	.54
Achievement	Reading Vocabulary	.68	.35	.83	.50	.75	X	X
	Reading Comprehension	.43	.80	.89	.88	.42	X	.39
	Word Analysis	NS	.37	.90	X	X	X	X
	Language Usage	X	X	X	.85	.88	X	.39
	Language Mechanics	X	X	X	X	X	X	.59
	Spelling	X	X	.84	.53	.70	X	X
	Math Computation	X	X	.73	.56	.64	X	.86
	Math Concepts	X	X	.86	.35	.15	X	.78
	Math Problem-Solving	X	X	.83	.42	.72	X	X

X = No data at this level on this variable

NS = Regression not Significant at acceptable level ($p < .05$)

*Adjusted for Pre-test standing except 1st grade data uses absolute post-test standing (no pre-test available) and Total Days Absence uses raw totals.

**Numbers Represent R^2

Classroom Functioning as a predictor of change varied with the dependent variable and with the grade level. However, there were several patterns in the data presented in Table 57.

First, teacher functioning was a good predictor of absolute standing at the end of the year for first grade students, in all areas except word analysis skills.

Second, except for the third and fourth grades, teacher functioning was a good predictor of the total days absent for her students. The relationship was an inverse one for all predictors except F-6 and F-7. The same trend was observed in third and fourth grades but it did not reach significance in the third grade regression and was not a high predictor at the fourth grade level.

Third, in general, teacher functioning was not as good a predictor of student gain in the fourth grade as it was for the other levels of students.

Fourth, above the fourth grade, teacher functioning was a better predictor of gain in skills than of gain in concepts. For example, in grades 7-12, the R-square for Language Mechanics was .59 but was only .39 for Language Usage. For Math Computation, the MCR square was .86 but, for Math Concepts, it was .78. The same situation was observed at grade 5. Reading Vocabulary was .75 and Comprehension was .42; Math Computation was .64, Math Problem-Solving was .72, and Math Concepts was .15. At the fourth grade level, prediction of change in Math followed the same pattern but not in reading. Below the fourth grade level, only the prediction of post-test standing for first grade follows the pattern, with Reading Vocabulary registering an R-square of .68 and first grade Reading Comprehension registering .43.

Identification of Predictors

The regression equations were examined to determine the relative predictive power of the independent variables. The dependent variables were grouped in three categories: (1) Absence, (2) Self-Concept Measures, and (3) Achievement Measures. Then the regression equations for each category were examined and the number of times a variable appeared as a predictor of change in regression equations at each level for each category was counted. This was divided by the number of equations for the category to get the percent of equations for the category in which the variable appeared as a predictor of gain. This operation was repeated for each category and for the total of all categories. The results are displayed in Table 58.

Table 58: Percent of Equations for Category in which Variable Appears* as a Significant Predictor of Gain

	Independent Variables	CATEGORY & LEVEL PREDICTED								
		ABSENCE		SELF-CONCEPT		ACHIEVEMENT		ALL CATEGORIES		
		EL.	SEC.	EL.	SEC.	EL.	SEC.	EL.	SEC.	1-12
Teacher Behaviors	F-1	20%	--	16%	20%	42%	--	30%	9%	26%
	F-2	20	200%+	50	20	30	40%	36	45	38
	F-3	20	--	22	--	30	40	26	18	25
	F-6	--	100	33	20	23	--	24	18	23
	F-7	40	--	33	20	46	80	40	45	41
	C-1	--	--	--	--	3	--	--	--	--
	C-2	20	--	11	--	23	--	18	--	15
	C-3	20	--	44	40	15	20	26	27	26
	C-4	40	--	--	40	19	20	14	27	16
Interpersonal Processes	Meaning	20	100	11	40	34	20	24	36	26
	Genuineness	40	100	11	--	34	--	26	9	23
	Success Promotion	20	--	5	--	3	--	6	--	5
	Respect	20	--	--	--	7	--	6	--	5
	Student Involvement	20	--	38	40	15	20	24	27	25
Student Behaviors	F-9	20	100	22	--	30	60	22	36	25
	C-5	--	--	11	--	15	20	12	9	11
	C-6	--	100	16	20	34	--	24	9	21
	C-7	--	--	11	--	34	40	22	18	21
	C-8	--	--	22	20	38	--	28	9	25
N of Equations		5	1	18	5	26	5	49	11	60

EL: Elementary (1-6)
SEC: Secondary (7-12)
*Variable is counted as appearing if either $\bar{X}$ or $\hat{b}$ appeared as predictor in regression.
+Variable appeared as both $\bar{X}$ and $\hat{b}$ in the regression.

Single Predictors

The most highly predictive single variables were F-1, F-2, F-3, F-7, F-9, C-3, C-8, M and SI. Cognitive 1 (Teacher Recalls Facts) was a predictor only for elementary Achievement and was negatively correlated with achievement. Cognitive 2 (Teacher Asks for Facts) was predictive for elementary students but not for secondary students. Of the Student Behavior variables, the most highly predictive were F-9 (Student Initiates) and Cognitive 8.

Predictive Clusters

To simplify this rather complex picture of the relative predictive power of the variables, the independent variables were grouped into four clusters according to the kind of behavior being measured. Then for each category of dependent variables, the predictive appearances of the independent variables were summed over each cluster and divided by the total number of predictive appearances of all variables for the category. This provided a picture of the relative power of the different clusters of Classroom Functioning Variables in predicting change. The results are displayed in Table 59.

The teacher's Cognitive Behaviors had relatively little predictive power except for Self-Concept at the secondary level. The Teacher's Specific Affective Behaviors and the Process Scales appeared more frequently as predictors than either Student Behavior or Teacher's Cognitive Behaviors. However, Student Behavior measures were frequent predictors of gain in Achievement. The percentage of predictive appearances of Student Behavior in Achievement regressions was almost the same for the Elementary and the Secondary levels although comparing the two levels reveals discrepant percentages for Student Behavior in Absence and Self-Concept Regressions.

Average Level vs. Stability of Functioning as Predictor

Tables 58 and 59 dealt with total appearances of a variable regardless of whether it appeared as a Mean (average level of teacher's functioning on that variable) or as a Standard Deviation (stability of teacher's functioning on that variable). Tables60 and 61 deal with the predictive appearances of the two kinds of measures for the variables.

In Table 60, the process used to produce Table 3 was repeated, except that for Table 60 only the appearances of standard deviations of the variables were counted for each cluster and divided by the total number of all (both $\bar{X}$ and $\hat{\sigma}$) appearances. This provided a picture of the percentage of

Table 59: Percent of Total Predictive Appearances in Category by Variable Clusters for School Level

Variable Cluster (Groupings of Independent Variables)	Level and Category Predicted					
	ABSENCE		SELF-CONCEPT		ACHIEVEMENT	
	EL.	SEC.	EL.	SEC.	EL.	SEC.
Specific Affective Behaviors	31%	42%	44%	28%	36%	44%
Teacher Cognitive Behaviors	25%	-0-	15%	28%	11%	11%
Process Scales	37%	29%	19%	28%	21%	12%
Student Behaviors	7%	29%	20%	16%	32%	33%

Specific Affective Behaviors:

F-1: Accepts Feelings
F-2: Uses Praise
F-3: Accepts &/or Uses Student Ideas
F-6: Gives Instructions
F-7: Justifies Authority

Process Scales:

Meaning, Genuineness, Respect for Student, Success Promotion, Student Involvement

EL: Elementary (1-6)
SEC: Secondary (7-12)

Teacher Cognitive Behaviors:

C-1: Teacher Recalls Facts
C-2: Teacher Asks for Facts
C-3: Teacher Thinks
C-4: Teacher Asks for Thinking

Student Behaviors:

F-9: Student Initiates
C-5: Student Recalls Facts
C-6: Student Asks for Facts
C-7: Student Thinks
C-8: Student Asks for Thinking

Table 60: Percent of Predictive Appearances in Category (by Variable Cluster per Level) that is Accounted for by Stability of Teacher Functioning Factors

Variable Cluster (Groupings of Independent Variables)	Level and Category Predicted					
	ABSENCE		SELF-CONCEPT		ACHIEVEMENT	
	EL.	SEC.	EL.	SEC.	EL.	SEC.
Specific Affective Behaviors	25%	14%	11%	14%	16%	22%
Teacher Cognitive Behaviors	12%	-0-	6%	14%	2%	-0-
Process Scales	6%	29%	11%	7%	13%	12%
Student Behaviors	-0-*	-0-	-0-	-0-	-0-	-0-

Specific Affective Behaviors:

F-1: Accepts Feelings
F-2: Uses Praise
F-3: Accepts &/or Uses Student Ideas
F-6: Gives Instructions
F-7: Justifies Authority

Process Scales:

Meaning, Genuineness, Respect for Student, Success Promotion, Student Involvement

EL: Elementary (1-6)
SEC: Secondary (7-12)

Teacher Cognitive Behaviors:

C-1: Teacher Recalls Facts
C-2: Teacher Asks for Facts
C-3: Teacher Thinks
C-4: Teacher Asks for Thinking

Student Behaviors:

F-9: Student Initiates
C-5: Student Recalls Facts
C-6: Student Asks for Facts
C-7: Student Thinks
C-8: Student Asks for Thinking

*No Stability Measures of Student Behavior Variables were included in the Analysis.

Table 61: Proportion of Predictive Appearances in Category by Variable Cluster Per Level that is Accounted for by Stability of Teacher Functioning Factors

Variable Cluster (Groupings of Independent Variables)	Level and Category Predicted					
	ABSENCE		SELF-CONCEPT		ACHIEVEMENT	
	EL.	SEC.	EL.	SEC.	EL.	SEC.
Specific Affective Behaviors	.80	.33	.25	.50	.46	.50
Teacher Cognitive Behaviors	.50	-0-	.40	.50	.21	-0-
Process Scales	.16	1.00	.57	.25	.68	1.00

Specific Affective Behaviors:

F-1: Accepts Feelings
F-2: Uses Praise
F-3: Accepts &/or Uses Student Ideas
F-6: Gives Instructions
F-7: Justifies Authority

Process Scales:

Meaning, Genuineness, Respect for Student, Success Promotion, Student Involvement

Teacher Cognitive Behaviors:

C-1: Teacher Recalls Facts
C-2: Teacher Asks for Facts
C-3: Teacher Thinks
C-4: Teacher Asks for Thinking

EL: Elementary (1-6)
SEC: Secondary (7-12)

Predictive Appearances in Category that is accounted for by the stability of teacher functioning.

In Table 61, the relative predictive power of the two kinds of measures for the independent variables (average level of functioning and stability of functioning) is emphasized. It displays the ratio (proportion) of appearances of the stability measures to the total appearances of the variables. By examining this table, it was apparent that the stability of the teacher's functioning in the Process Levels was more important to secondary school students than to elementary students except in predicting self-concept changes. However, the stability of the Specific Affective Behaviors was more important than average level of functioning in predicting the Absence of elementary students. Compare this with the proportion for prediction of Absence by stability of Process levels. With a proportion of .16, it is evident that it is the average level of Interpersonal Process functioning that is more important for the elementary student.

DISCUSSION

General Relationships

In all but four of the 64 multi-linear regression analyses conducted in this study, the Classroom Functioning Variables were related to the student outcome measures at levels of significance less than .05. R-squares achieved in the significant regressions ranged from .14 to .88.

The relationships reported in this study are somewhat stronger than those reported for similar studies by previous investigators. Factors related to the added strength of the relationships reported here include the following:

1. The independent variables were measures of the actual processes occurring in the learning situation rather than presage characteristics of the teacher, the students, the curriculum, or the learning context.

2. The independent variables were generated from repeated measures of the processes occurring in the learning situation, thus providing (1) an average level of functioning for the year and (2) an estimate of stability of functioning for the year.

3. The dependent variables were not change for individual students but were mean change for all the students taught by the teacher.

4. The R-squares reported are for a component of the total variance; i.e., the variance remaining after the variance due to pre-test standing has been adjusted for.

Although the specific relationships between the Classroom Functioning Variables and the Change measures varied considerably from grade to grade and from test to test, the data presented here seems to indicate that the teacher's level of functioning is an important contributor to student change as it accounted for one-quarter to nine-tenths of the variance for all but eight of the relationships tested. (See Table 57). The generally low R-squares for the fourth grade (in comparison to the other grades) are interesting and it is hypothesized that these may be related to the "fourth grade slump" in creativity and achievement reported by other researchers.

Specific Patterns

Of particular interest to the researchers were the relationships between the Classroom Functioning variables and student absenteeism. As indicated in Table 59, the Specific Affective Behaviors and the Process Scales were the most frequent predictors of absence at both the elementary and the secondary levels with Student Behavior variables having an equal importance at the secondary level. Examination of the regression equations indicate that student absenteeism increases when process levels, number of questions asked by the teacher, praise, acceptance of student ideas, and acceptance of student feelings are lowered or when criticism is high. Similarly, there is an inverse relationship between absenteeism and student initiation and students asking for facts. Put simply, this means that when the teacher is functioning at high levels of acceptance and responsiveness to students, they miss fewer days of school during the year.

The second interesting pattern of relationships displayed in Table 57 is the systematically higher R-squares for skills tests compared to measures of more abstract kinds of learning for grades 1, 4, 5, and 7-12. In terms of this data, it would seem that, at the upper grade levels, the teacher has a more direct effect on students' attainment of specific skills than on their attainment of concepts or more abstract processes. That this pattern is also reflected in grade 1 reading but not in grades 2 and 3 may be an effect of the nature of first grade reading instruction.

The researchers had hypothesized that the Classroom Functioning variables would have stronger relationships with the Self-Concept Factors than with achievement tests. However, this hypothesis had to be rejected as the average

of the R-square for all Self-Concept regressions was .55 while the average for the Achievement regressions was .62. In effect, the Classroom Functioning variables were equally effective predictors for change on both the Self-Concept Factors and the Achievement tests.

Relative Predictive Power of Variable Clusters

Table 59 presents the relative predictive power of the different kinds of Classroom Functioning variables. For elementary students (grades 1-6) the Specific Affective Behaviors are most important, followed by Student Behaviors and Process Scales with the Teacher's Cognitive Behaviors contributing less to the variation of both Self-Concept and Achievement measures. Of the Student Behaviors, the most predictive were F-9 (Student Initiates) and C-8 (Student Asks for Thinking) indicating the importance of student participation and student direction setting in learning. Examination of the regression equations indicate that the relationships are in similar directions to those for Absenteeism; i.e., positive gain is positively related to the Classroom Functioning variables except F-6, F-7, and C-1. When F-7 and C-1 appear as predictors, they are usually negatively correlated. F-6 is positively correlated with elementary student gain and negatively correlated with secondary student gain.

The data presented in Table 61 as to the proportion of predictive appearances of the variables which were contributed by the stability of functioning factors indicates that both stability (the teacher offers relatively the same levels of functioning; i.e., has a small standard deviation around his own mean) and average level of functioning were of equal importance for about half of the relationships. However, the stability of the Specific Affective Behaviors were more frequent predictors of elementary Absenteeism than the average level of functioning while for the secondary students the stability factors were the only Interpersonal Process factors which predicted either Absenteeism or Achievement. Stability factors did not account for a large proportion of the appearances of Teacher Cognitive Behaviors as predictors of change in student outcomes.

SUMMARY

In conclusion, the findings from this study were:

1. The Classroom Functioning variables are good predictors of student change when raw change is adjusted for pre-test standing.

2. When the teacher is functioning at high levels of acceptance and responsiveness to students, students miss fewer days of school during the year.

3. At the upper grade levels, the teacher has a more direct effect on students' attainment of specific skills than on attainment of concepts or more abstract processes.

4. The Classroom Functioning variables were equally effective predictors for change on both Self-Concept factors and Achievement tests.

5. Both the stability of the teacher's functioning and the average level of functioning on Specific Affective Behaviors and Process Scales are important predictors of change but the relative importance of the two kinds of measures of teacher functioning vary with the kind of gain predicted and the grade level of the student.

6. The stability of the teacher's functioning in the Cognitive Behaviors was not an important predictor of change, but average level of functioning was.

7. Student gain (positive change) was positively related to the Classroom Functioning variables except F-7 and C-1 which were inversely related while F-6 was positively related for elementary students and inversely related for secondary students.

The conclusion of the researchers from this study was that higher functioning teachers produce more gain in student measures of Self-Concept and Achievement and their students are absent fewer days.